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17. Proposed by H. W. HOLYCROSS, Superintendent of Schools, Pottersburg, Union County, Ohio.

A gentleman owns a circular farm, and if three circles of equal area and as large as possible be drawn within it, the circular area in the center of the farm will contain one acre; what is the area of the circular farm?

Solution by SETH PRATT, C. E., Assyria, Michigan; Professor G. B. M. ZERR, Principal of High School, Staunton, Virginia; A. H. BELL, Hillsboro, Illinois; and J. W. Watson, Middle Creek, Ohio.

Let $AD = BD = CE = r$, $OK = R$, and area $FDE = 1 \text{ A.} = 160 \text{ sq. rd.} = \pi$. Then $AB = AC = BC = 2r$, $CD = \sqrt{(AC^2 - AD^2)} = \sqrt{(4r^2 - r^2)} = r\sqrt{3}$, and area of $\triangle ABC = \frac{1}{2}(AB \times CD) = \frac{1}{2}(2r \times r\sqrt{3}) = r^2\sqrt{3}$.

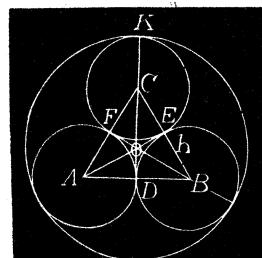
The area of the circular sector $DAF = \frac{1}{6}$ of circle whose center is $A = \frac{1}{4}\pi r^2$. Hence, the area of the three sectors within the triangle $ABC = \frac{1}{2}\pi r^2$.

Hence, the area $FDE = r^2\sqrt{3} - \frac{1}{2}\pi r^2 = \frac{1}{2}r^2(2\sqrt{3} - \pi) = a$, whence $r = \sqrt{\frac{2a}{2\sqrt{3}-\pi}}$. Now $CD = r\sqrt{3} =$

$$\sqrt{3}\sqrt{\frac{2a}{2\sqrt{3}-\pi}} \quad \text{and} \quad OC = \frac{2}{3}CD = \frac{2}{3}\sqrt{3}\sqrt{\frac{2a}{2\sqrt{3}-\pi}}.$$

$$\text{Hence, } R = OK = OC + CK = \frac{2}{3}\sqrt{3}\sqrt{\frac{2a}{2\sqrt{3}-\pi}} + \sqrt{\frac{2a}{2\sqrt{3}-\pi}} = \left(\frac{2\sqrt{3}+3}{3}\right)\sqrt{\frac{2a}{2\sqrt{3}-\pi}}.$$

$$\therefore \text{Area of the circle whose center is } O = \pi R^2 = \frac{2}{3}\pi \left(\frac{7+4\sqrt{3}}{2\sqrt{3}-\pi}\right)a = 90.4534 + A.$$



This problem was also solved by JOHN T. FAIRCHILD, J. F. W. SCHEFFER, M. A. GRUBER, H. C. WHITAKER, H. W. HOLYCROSS, I. L. BEVERAGE, and P. S. BERG.

18. Proposed by L. P. HAYWARD, Superintendent of Schools, Bingham, Ohio.

In a circle whose radius is 6, find the area of the part between parallel chords whose lengths are 8 and 10, both being on the same side of the center.

Solution by H. W. HOLYCROSS, Superintendent of Schools, Pottersburg, Ohio; P. S. BERG, Apple Creek, Ohio; I. L. BEVERAGE, Monterey, Virginia; Professor G. B. M. ZERR, Principal of High School, Staunton, Virginia.

$$h' = 6 - \sqrt{6^2 - 4^2} = 1.528, \text{ height of smaller segment.}$$

$$h = 6 - \sqrt{6^2 - 5^2} = 2.683, \text{ height of larger segment.}$$

$$\text{Area of larger segment} = \frac{h^3}{2b} + \frac{2hb}{3} = 454 - \frac{371}{3}\sqrt{11} = 43.8595.$$

$$\text{Area of smaller segment} = \frac{h'^3}{2b'} + \frac{2h'b'}{3} = 68 - 80\sqrt{5} = 8.37173 +$$

$$\therefore \text{Required area} = 43.8595 - 8.37173 = 35.48777.$$

This problem was also solved by H. C. WHITAKER, W. F. BRADBURY, JOHN T. FAIRCHILD, J. F. SCHEFFER, and J. W. WATSON.

PROBLEMS.

25. Proposed by L. B. HAYWARD, Superintendent of Schools, Bingham, Ohio.

A company engaged an agent to do business for one month at a salary of \$25, giving him goods amounting to \$57.54 and \$32.17 in cash to start with. The agent bought during the month, goods amounting to \$59.91. At the end of the month the